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ZOOLOGY.—*On the ranges of certain crayfishes of the Spiculifer group of the genus Procambarus, with the description of a new species*<sup>1</sup> (Decapoda: Astacidae). HORTON H. HOBBS, Jr., University of Virginia. (Communicated by Fenner A. Chace, Jr.)

Six species of crayfishes belonging to the Spiculifer group of the genus *Procambarus* are known to inhabit lotic situations in Alabama, Florida, Georgia, and South Carolina. Of these, three have been described: *P. spiculifer* (LeConte, 1856:401), *P. versutus* (Hagen, 1870:51), and *P. suttkusi* Hobbs (1953:173). A description of the fourth is given below; however, before those of the other two are made larger series of both are needed.

Plotted on the accompanying map are the locality records available for the four described species. Since *P. spiculifer* and *P. versutus* are known from so many localities, a listing of the localities from which they have been collected seems superfluous; however, exact locality data have been given for *P. suttkusi* and are listed for the species described below.

The greatest gap in our knowledge lies in the region of the middle Chattahoochee and in the Alabama River system. It will be noted from map 1 that *P. spiculifer* is known from headwater streams of the Alabama River in Georgia as well as from localities near its mouth, but whether it occurs in the region between is not known. Specimens of *P. spiculifer* from over its entire known range have been examined rather carefully, but variations are few, and in no place where adequate series are available do any of these variations seem to be confined to local populations. A study of variations in *P. versutus* has been deferred until more specimens from central Alabama become available.

<sup>1</sup> Contribution from the Samuel Miller Biological Laboratories. I wish to thank Dr. E. C. Raney and Dr. D. C. Scott for their kindness in collecting for me the specimens on which this description is based, as well as for those on which many of the locality records indicated on the map are established.

Genus *Procambarus* Ortmann (1905)

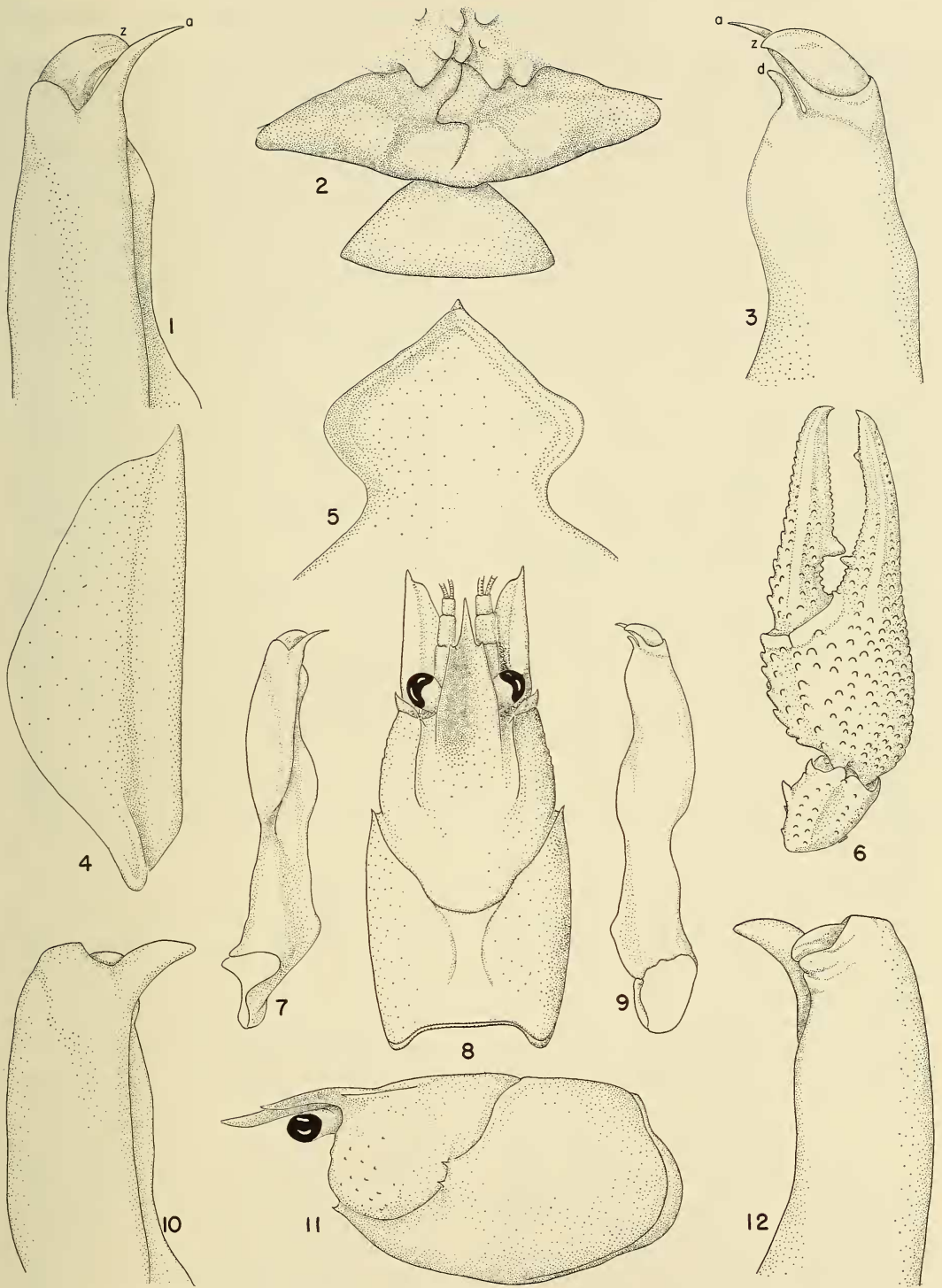
*Procambarus raneyi*,<sup>2</sup> n. sp.

*Diagnosis*.—Rostrum with lateral spines and without a median carina; areola relatively broad and short (about four times as long as broad and about 28 per cent of entire length of carapace); two lateral spines on each side of carapace. Male with hooks on ischiopodites of third and fourth pereopods; palm of chela of first form male not bearded but bearing a row of 7 to 9 tubercles along mesial margin. Post-orbital ridges terminate cephalad in spines. First pleopod of first form male (Figs. 1 and 3) without a shoulder on cephalic margin and terminating distally in three distinct parts. Mesial process subspiculiform and directed caudodistad; cephalic process absent (as in *P. spiculifer*); caudal element consists of a small corneous curved tooth lying at the caudal base of the central projection; the compound central projection, the most conspicuous of the terminal elements, beaklike, corneous, and with its tip directed caudad; as is usual the centrocephalic process is much larger than the centrocaudal one. Annulus ventralis partially hidden by tuberculate extensions from the sternum anterior to annulus (Fig. 2).

*Holotypic male, form I*.—Body subovate, somewhat compressed laterally; abdomen slightly shorter than carapace (53.2-55.2 mm). Height and width of carapace in region of caudodorsal margin of cervical groove subequal; greatest width of carapace a little cephalad of caudodorsal margin of cervical groove (25.3 mm).

Areola relatively broad and short, about 4.4

<sup>2</sup> I name this species in honor of my good friend Dr. Edward C. Raney, of Cornell University, who has so graciously donated to me large numbers of crayfishes which he has collected while studying the fishes in the eastern part of the United States. Without his aid our knowledge of the crayfishes of the Atlantic slope would have been considerably hampered.



FIGS. 1-12.—*Procambarus raneyi*, n. sp. (Pubescence removed from all structures illustrated): 1, Mesial view of distal portion of first pleopod of holotype; 2, annulus ventral of allotype; 3, lateral view of distal portion of first pleopod of allotype; 4, antennal scale of holotype; 5, epistome of holotype; 6, distal three podomeres of cheliped of holotype; 7, mesial view of first pleopod of holotype; 8, dorsal view of carapace of holotype; 9, lateral view of first pleopod of holotype; 10, mesial view of distal portion of first pleopod of morphotype; 11, lateral view of carapace of holotype; 12, lateral view of distal portion of first pleopod of morphotype (a—mesial process; d—caudal process; z—central projection.)

times as long as wide with five or six punctations in narrowest part. Cephalic section of carapace about 2.3 times as long as areola (length of areola about 27.6 percent of entire length of carapace).

Rostrum moderately long, excavate; sides subparallel basally, slightly converging distally to base of long acumen which is set off by acute lateral spines. Acumen longer than half the remainder of rostrum. Margins of rostrum not swollen or conspicuously elevated. Upper surface with a few scattered minute setae. Subrostral ridges poorly developed and not evident in dorsal aspect.

Postorbital ridges prominent, shallowly grooved laterally, and terminating cephalad in acute spines. Suborbital angle weak and obtuse; branchiostegal spine strong. Two strong acute spines present on each side of carapace; upper surface of carapace punctate and lateral surface granulate.

Cephalic section of telson with two spines in each caudolateral corner. Margin of subtriangular epistome plumose with a very small cephalo-median spine (see Fig. 5).

Antennules of the usual form with a strong acute spine present on ventral side of basal segment.

Antennae extend caudad to telson. Antennal scale long; moderately broad; widest near mid-length; outer distal margin with a moderately strong spine.

Right chela depressed with the palm inflated in middle; outer margin of hand concave at base of immovable finger. Hand entirely tuberculate. Inner margin of palm with a row of seven tubercles, with one tubercle below this row and a row of four just above it; a very prominent tubercle present on lower surface of palm at base of dactyl. Opposable margin of dactyl with a row of 23 rounded tubercles, the fifth from base largest and forming a distinct emargination; upper surface of dactyl with a low rounded submedian longitudinal ridge flanked on proximal two-thirds by tubercles and distally by setiferous punctations; mesial margin of dactyl with 12 tubercles; lower margin of dactyl similar to upper surface. Immobile finger with opposable margin concave and bearing an upper row of 24 rounded tubercles, sixth from base largest, and a lower row along distal half of 9 tubercles of which the sixth from base is largest; upper and lower surfaces similar to those

of dactyl; although less tuberculate, lateral margin of immovable finger with a rounded longitudinal ridge flanked by tubercles proximally and setiferous punctations distally.

Carpus of first right pereiopod longer than broad; upper surface with a deep submedian furrow, flanked mesially by two rows of tubercles and laterally by less well defined rows; submedian furrow interrupted distally by a small tubercle near distal margin of podomere. Mesial surface with row of five tubercles, the third and fifth distinctly larger than others. Lower mesial margin with a row of four tubercles, the distal one of which is largest and corresponds to the mesial member of the usual two tubercles present on distal margin. Between these two rows is a group of four small tubercles. Lower surface with a large distal tubercle and a few scattered small ones. Lateral surface with small squamous tubercles.

Merus of first right pereiopods with small tubercles and scattered punctations on lateral surface; upper surface with tubercles along entire length, except near distal extremity, with two of the more distal ones distinctly larger than the others; mesial surface smooth proximally, with a few tubercles distally, and somewhat excavate along middle three-fourths, producing a longitudinal furrow near lower margin. Lower surface with two rows of spikelike tubercles, an outer one of 15 and an inner one of 15; scattered small tubercles are present between and to the side of these two rows.

Lower surface of ischiopodite bearing a mesial row of five spikelike tubercles and a lateral row of small tubercles; these are continuations of the corresponding rows on merus.

Basipodite and coxopodite with no tubercles.

Hooks present on ischiopodites of third and fourth pereiopods; hooks are both long and slender and only slightly recurved. Basipodite of fourth pereiopod bears no tubercle opposing the hook on ischiopodite; hooks of both third and fourth pereiopods extend proximad of distal end of their respective basipodites. Coxopodites of fourth and fifth pereiopods with caudomesial projections: that on fourth heavy and inflated, and that on fifth somewhat smaller and more sharply defined.

First pleopod extending to coxopodite of third pereiopod when abdomen is flexed. Tip terminating in three distinct parts (Fig. 3). Mesial process spiculiform and gently curved

caudodistad; cephalic process represented by a mere rounded lobe at cephalic base of central projection; caudal element consists of a corneous well-defined caudal process and a very small and poorly defined caudal knob; central projection, the most conspicuous of the terminal elements, corneous, broad (cephalocaudal axis), and directed caudolaterad.

*Allotypic female*.—The allotype differs only in a few minor details from the holotype; opposable margin of dactyl of right chela with 14 tubercles; opposable margin of immovable finger of chela with upper row of 10 tubercles and no lower row; inner surface of carpus of left chela with three major tubercles instead of two; two rows of tubercles on lower surface of merus with fewer tubercles than in holotype. See measurements for differences in proportions.

Annulus ventralis only slightly obscured in ventral aspect by small tubercles extending caudally from sternum immediately cephalad of annulus. Annulus subovate with the greatest length in the transverse axis; a transverse depression near midlength with high wall cephalad cut by a troughlike depression; caudomesial portion with a raised (ventrally) prominence. Sinus originates along median line near cephalic margin of annulus, extends caudodextrad and turns sharply sinistrad to cross the median line, and from there curving gently caudad to the midcaudal margin of the annulus (Fig. 2).

*Morphotypic male, form II*.—Differs from the holotype in the following respects: Abdomen slightly longer than carapace (52.8–50.8 mm); inner margins of palm of right chela with a row of three tubercles above the main row and only one below it; opposable margin of dactyl with a row of 18 tubercles, the fourth from base largest; opposable margin of immovable finger with upper row of 16 tubercles, fourth from base largest, and lower row of four. Lower surface of merus with mesial row of 14 tubercles and a very irregular lateral row. Hooks on ischiopodites of third and fourth pereopods much reduced and neither extends proximad of basipodite of respective appendage. Prominences on coxopodites of fourth and fifth pereopods much reduced.

First pleopod with three terminal elements visible (Figs. 10 and 12); the conspicuous mesial process directed caudally as are the less prominent caudal process and central projection.

*Measurements*.—As follows (in mm):

	Holotype	Allotype	Morphotype
Carapace:			
Height .....	25.2	23.1	24.0
Width .....	25.3	22.9	24.4
Length .....	55.4	47.1	51.0
Areola:			
Length .....	15.3	13.4	14.3
Width .....	3.7	3.7	4.0
Rostrum:			
Length .....	18.2	14.6	15.8
Width .....	8.5	7.6	8.2
Right chela:			
Length of inner margin of palm .....	19.4	10.1	13.5
Width of palm .....	20.5	12.2	13.8
Length of outer margin of hand .....	51.5	28.8	22.2
Length of dactyl .....	31.8	16.9	38.3

*Type locality*.—South fork of the Broad River, 1 mile south of Carlton on the Oglethorpe–Madison County line, Georgia (Savannah River drainage system).

*Disposition of types*.—The holotypic male, form I, allotypic female, and morphotypic male, form II are deposited in the United States National Museum (nos. 95124, 95125, and 95126, respectively). Of the 39 paratypes, one male, form I, one male, form II, and one female are deposited in the Museum of Comparative Zoology, and a similar series in the collection of Dr. G. H. Penn. One male, form I, is deposited in the United States National Museum and four males, form I, two males, form II, 15 females, 7 juvenile males, and 14 juvenile females are retained in my personal collection at the University of Virginia.

*Relationships*.—*Procambarus raneysi* has its closest affinities with *P. spiculifer* (LeConte); however, it may be distinguished from the latter by the structure of the first pleopod of the male and the annulus ventralis of the female.

*Specimens examined*.—All these specimens were collected from streams.

#### SAVANNAH RIVER DRAINAGE

GEORGIA: *Madison–Oglethorpe County* line—9-1150-1, Anthony Shoals (south fork of Broad River) 1 mile south of Carlton [type locality], 4♂♂ I, 1♂ II, 7♀♀, 5 juv. ♂♂, 11 juv. ♀♀, D. C. Scott, coll.; 4-1550-2a, same locality, 2♂♂, D.C.S., coll. *Madison County*—4-1550-1a, Small ck., 5 miles east of Carlton, 1♀, D.C.S., coll.; 4-1550-3, Masons Creek, 11 mi. W. of Royston on Route 29, 1♂ II, 1♀, D.C.S., coll.; U.S.N.M. no. 93253 (9/10/47), trib. of Broad River, 0.7 miles southwest of Danielsville on Route 29, 1♂ I, E. I. Lachner, coll. *Elbert County*—

4-1550-2a, 2.5 miles east of Broad River on Route 77, 2♂♂II, 2♀♀, 1 juv.♂, D.C.S., coll.; 3-2751-5a, Morea Creek, 1.5 miles south of Nuberg on Route 77, 2♀♀, E. C. Raney, coll. *Stephens County*—4-947-2b, north fork Broad River, 3.7 miles west of Toccoa, 1 juv.♂, 1 juv.♀ E.C.R., coll.

*SOUTH CAROLINA: Abbeville County*—3-2751-1b, Calhoun Creek, 7.6 miles east of Calhoun Falls on Route 72, 2♂♂I, 1 juv.♀, E.C.R. coll.; 3-2751-3, same locality, 1♂I, E.C.R., coll.; 3-2751-4, Long Crane Creek, 4.4 miles east of Abbeville, 1♀, E.C.R., coll.; 3-2751-6, Little River, 5.6 miles east of Calhoun Falls on Route 22, 1♂II, 2♀♀, 1 juv.♀, E.C.R., coll.

OCMULGEE RIVER DRAINAGE

GEORGIA: *Dekalb County*—3-2950-2, Flat Shoals on South River near Decatur, 4♂♂I, 4♀♀, E.C.R., coll.

*Discussion.*—*Procambarus raneyi* inhabits tributaries of the Savannah River in the Piedmont Province in Georgia and South Carolina and is known from a single locality in the headwaters of the Ocmulgee River (Altamaha River drain-

age) in Dekalb County, Ga. This latter locality, an isolated one, is of considerable interest, for here this species is surrounded by its nearest relative, *P. spiculifer* (see map 1), which is found in the Chattahoochee, lower Ocmulgee, and Oconee drainages. The simplest explanation as to how *P. raneyi* gained entrance into the headwaters of the Ocmulgee would involve transport by human agencies. There seems to be little reason to assume, however, that once introduced into a stream which is largely dominated by *P. spiculifer* it would be able to replace the latter. Certainly from an anatomical standpoint it has no obvious advantageous characteristics, and there are no data available concerning the reproductive capacities of either species. Although there is no geological evidence, nor are there other evidences, to support any other explanation for their presence here, it does not seem amiss to pose the question as to whether or not the Dekalb County population represents a relict fauna.

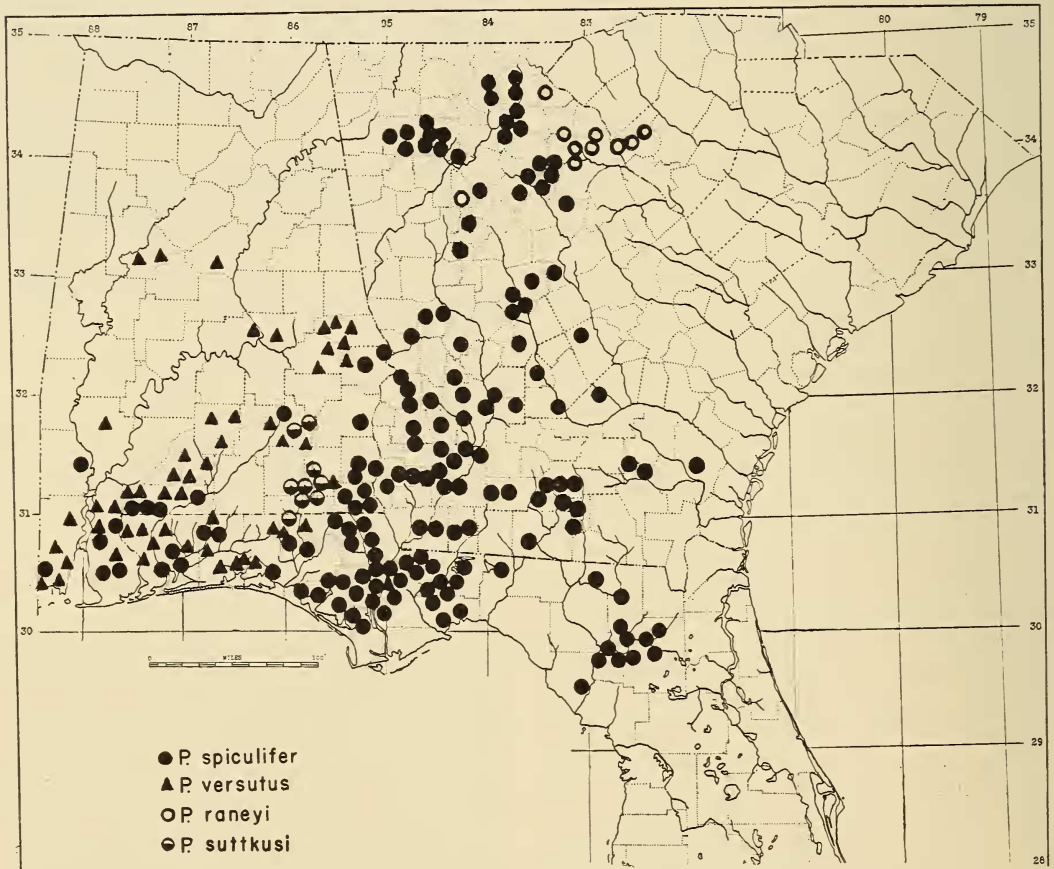


FIG. 13.—Map of locality records for four species of *Procambarus*.